Expression or Repression of Genes

Gene Regulation:

- Only a small portion of genes are expressed at a time.
- An expressed gene is a gene that gets transcribed into mRNA.
- A "silent" gene is a gene that is not transcribed into mRNA.
- Humans have 30,000-40,000 protein -coding genes [~ 5% of the DNA Code of 3 billion base pairs, the rest are silent (we have not found a function for them.)]

What are these other base pairs for:

- Promoters: Binding sites for RNA polymerase which allows for transcription to begin.
- Start and Stop transcription signals
- "Regulatory Sites": next to promoters, places where other proteins can bind directly to DNA sequences to regulate transcription (turn genes on or off)

Gene regulation:

- Operon: a cluster of genes that are turned on or off together, genes that act as one.
  - Generally found only in prokaryotes
- Repressors:proteins that regulate whether a gene is turned on or off by the presence or absence of chemicals in the cell.
- Operator: region of a chromosome in an operon to which a repressor binds when the operon is turned off.

Gene regulation in Eukaryotes:

- Generally there are no operons
- "TATA box": a short region of DNA that is ~30 base pairs long that contains a TATATA or TATAAA sequence, before transcription begins; helps position the RNA polymerase by marking the point just before transcription is to begin.
- Promoters: generally are found just before a "TATA box", contains a series of short DNA sequences.
- HOX Genes: control differentiation in cells

Eukaryotic regulation cont...

- Enhancer sequences: located just before the point where transcription begins (just before promoter)
  - some block access to genes (negative control)
  - provide easier access to genes (positive control)
  - some attract RNA polymerase
  - some open the tightly packed chromatin
  - many different ehnhancer sequences are affected by many different proteins which is the reason eukaryotic gene regulation is so complex.